European Commission

Business Innovation Observatory

Servitisation

Service and predictive maintenance contracts

Case study 66

Internal Market, Industry, Entrepreneurship and SMEs

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Servitisation

Service and predictive maintenance contracts

Business Innovation Observatory
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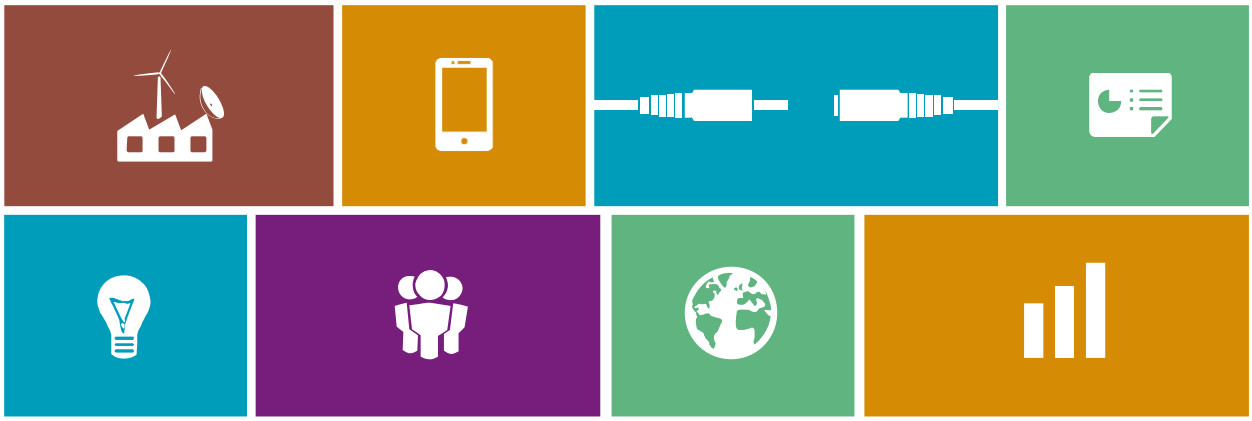


1. Executive summary

The fourth industrial revolution is founded on the convergence between traditional industries and the digital sector. We are seeing a rapid integration of smart products with intelligent, personalised services, placing the consumer at the centre.

Service maintenance contracts are increasingly used when original equipment manufacturers (OEMs) change their business models **from product makers to product-as-a-service providers**. Selling products-as-a-service is a whole and distinct value proposition offered to customers where they are **promised life-long support for periodical, monthly or yearly, subscriptions stated in service contracts**.

Adding value to products is a very important pillar in the strategy of manufacturers wishing to retain long-lasting customer relationships. In this context, the manufacturing industry is lagging behind and over the past years has started adopting the service concept. This creates **opportunities for OEMs and third-party service providers to offer services such as training, help desks, process design, financial support, insurance offerings and new technology services i.e. the use of sensors. Even complex solutions that combines different kinds of services are offered by OEMs and other service providers**. Preventive maintenance and maintenance on pre-scheduled visits are still popular but there is an increasing demand for predictive maintenance. **Predictive maintenance uses sensors and remote monitoring to predict failures before they occur**.

With falling profit margins on products, **OEMs are looking at services to generate predictable revenue streams**. The trend is transforming a market primarily dominated by manufacturers that have for centuries been taking the traditional approach of buying supply, manufacturing and then selling a product. Having seen the consumer market, where products are bought online with the possibility of customisation, the same principle is today being applied in industry. The market however needs more engineering- and IT-specialists in order to pursue advanced, professional and qualitative maintenance services that could also be called 'smart' business services.

Since **margins of products are falling, competition from low-cost manufacturers overseas is rising and customer preferences are changing**, OEMs and equipment providers must adapt and differentiate by providing value-added services. **Technological advances such as M2M, big data analytics and the cloud are enabling services such as predictive maintenance.** Since manufacturers constantly seek out means to **reduce costs and boost efficiency** there are several parameters driving the market of service-contracts and life-long support.

However, **in certain cases services are seen as a premium rather than a necessity**, making it a challenge for OEMs and equipment providers to sell an integrated value proposition. Providing services through distributors is sometimes a must in order to provide service support worldwide but this in turn may lead to a **loss in control over service quality**. It is also a **challenge to hire the right people** because these types of services increasingly need specialists with new types of knowledge, especially in emerging technologies, that are not traditionally found in the manufacturing industry.

Accordingly, policymakers can support servitisation (integrating services into manufacturing) efforts by **providing collaboration and knowledge platforms** which not only help educate entrepreneurs and business executives on the **practicalities and potentialities associated with servitisation**, but **create matchmaking**

opportunities between firms. **Access to a skilled workforce that has expertise in the fields of IoT, big data and analytics** is also key, as well as the **raising of awareness of the value proposition of predictive maintenance services** to spur further growth of SMEs in the European market, in particular in growth segments such as smart business services.

2. Service and predictive maintenance contracts for machines and equipment

2.1. Trend presentation

In traditional contracts for capital goods, the initial purchasing of a system and the subsequent life cycle support are normally procured separately. The provision of services was considered a liability by the manufacturers and the service department operation thought to be a cost centre. But with time manufacturers realised that services can ensure them additional revenues along with product sales. Today, **services are an important pillar of the strategy for manufacturers,** as they serve to **enhance the value of existing products.** As manufacturing gets commoditised, manufacturing firms increasingly rely on services as a differentiator and revenue generator. Hence, many manufacturers now offer sales contracts which include a fixed price that covers activities related to maintenance for a fixed period. To reduce overall services costs considerably without affecting the product performance, there is an increasing tendency to offer preventive services such as mandatory servicing at pre-defined intervals or predictive algorithms and innovative remote diagnostics via review of data from sensors monitoring machines in order to pick up any patterns that indicate a possible fault.

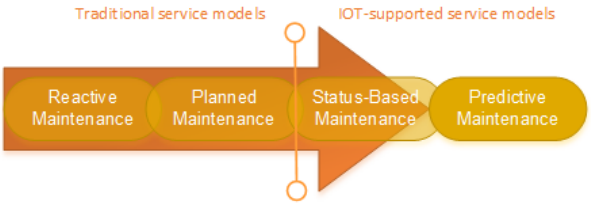
Service contracts (i.e. sales contracts, field-service maintenance, rental packages, performance-based services) and subscriptions is the **next generation business model** for original equipment manufacturers (OEM's) because it moves them **from being reactive to** becoming **proactive**, from using standard pricing to consumption based methods and from traditional transactional engagements to lifetime value-based engagements.[1] OEMs and third-party service providers likewise agree to help manufacturers reach their objectives rather than just sell the product.[2] In particular, **OEMs are realising that products and services are not to be sold as separate, but as a whole and distinct value proposition** which entitles new types of revenue streams. In fact more than 60 per cent of organisations believe that service contracts will be their top service strategy over the next three years.[3]

"We help them from our expert position to further improve processes, not only to remain at the status where they are in the beginning but to grow together with our services."
*– **Aircrete***

Traditional services such as reactive and preventative maintenance are still being offered but the tendencies are pointing at offering predictive maintenance (Figure 1). **Predictive maintenance helps customers monitor the health of their equipment in near real-time data to detect abnormalities before they occur**, optimising quality, inventory and efficiency in manufacturing at lower costs.[4] Those costs are associated with minimising time of the equipment being maintained, minimising loss of production hours due to maintenance and the cost of spare parts and supplies[5] Simultaneously it serves the OEM and/or third-party service provider with knowledge about customer use which drives the product and service innovations forward while enhancing customer experience. Connected products are able to order spare parts themselves for example, and wirelessly connected products are estimated to rise from 5 billion to 21 billion by 2020 (smartphones and computers are not included).[6]

"We have noticed that now it is a substantial increase on this....The potential is huge."
*– **PlantVision***

Figure 1: Offering advanced services as part of service contracts in servitisation



Source: Reply[7]

According to a recent study, **65 per cent of German production managers believed predictive analytics improved adherence to delivery dates and 70 per cent believed that it helped German industries becoming more efficient and innovative.**[8] Another study, made on power generators, revealed that changing the approach from preventative to predictive maintenance reduced maintenance costs from 30 per cent to 25 per cent, breakdowns from 75

per cent to 70 per cent and increased the overall equipment effectiveness by 8 per cent. Currently, the amount of maintenance time spent on predictive maintenance activities is on average 15 percent, but manufacturers would like to increase this to 33 percent, while reducing the time spent on reactive and preventative maintenance (currently representing 40 and 45 percent of maintenance time respectively).[9] 57 per cent of the "Best in class servitisation firms" have planned for future service demand and 40 per cent have implemented predictive analytics as a strategic action.[10] "Best in class" firms that already adopted above mentioned techniques as strategic initiatives have seen annual improvements in service revenue grow by nearly 12 per cent compared to others with an annual growth of 3 per cent.[11]

2.2. Overview of the companies

The following section describes four small-to-mid-sized companies operating in the realm of service and predictive maintenance.

Table 1: Overview of the company cases referred to in this case study

Company	Location	Business innovation	Signals of success
WasteSpectrum	UK	WasteSpectrum are market leaders in designing and manufacturing incinerators with life-long support. The company rents out their BioSecure waste disposal machines over a five-year contract with service and support included.	- Since being founded in the 1990s, they are today offering their product in 69 countries on all 7 continents - World leaders in the market - 20 per cent of the yearly revenues are from services - It has 35 employees (as of mid 2014)[12]
Aircrete Europe	NL	Aircrete operates in the industrial construction sector offering their clients complete solutions for design, manufacture and operations of lightweight environmentally friendly concrete. Heavy focus is placed on remote control and preventive maintenance services for fixed periods based on technology developed in-house.	- 40 years of experience and world-wide operations - It has a yearly turnover of approximately EUR 10 million - 25 per cent of the yearly revenues are from services
PlantVision	SE	PlantVision is a small software developer on a market with a high potential for growth. Their clients operate in industrial manufacturing and life science technology where an increasing demand for real-time monitoring and predictive maintenance is key. PlantVision leases out solutions targeting big manufacturers through their PlantPerformance branch.	- Profitable since 1999 - Contracted several giant players in the industrial and life-science manufacturing sectors - It has a yearly turnover of approximately EUR 8 million, and has close to 70 employees
Brevetti C.E.A	IT	Brevetti C.E.A manufactures inspection machines for the pharmaceutical industry. Preventive and predictive maintenance, remote solutions, embedded engineers and training is an integral part of the product as a service offering with a contract period of at least 10 years.	- More than 2,000 inspection machines installed worldwide - Solely offers predictive maintenance - It has a yearly turnover of approximately EUR 29 million, and has approximately 120 employees

Problem 1 – Animals suffering from disease can affect entire flocks. Outbreaks such as mad cow disease, swine flu or Ebola put larger communities at risk. Tackling such outbreaks using incinerators and waste disposal machines are costly. Because of which there is demand for cheaper alternatives to secure against diseases.

Innovative solution 1 – WasteSpectrum develops, manufactures and services incinerators. These incinerators handle animal carcasses and medical, clinical and municipal waste. The outbreak of the disease can be much better controlled as the incinerators can be moved to the source of disease instead of the reverse, thus preventing people and animals in surrounding areas from being put at risk.

In turn, WasteSpectrum offers its clients throughout the world full service on their products, and has moved from transactional sales to longer-term service contracts typically lasting 5 years. The customers are guaranteed equipment availability, reliability and maintenance for a monthly payment plan. All distributors worldwide are given training and support both on-site and in the UK. The service offerings and support provided are mainly driven by the distributors themselves and are available worldwide. The revenues from services have contributed to 20 per cent of the company's turnover.

WasteSpectrum's mobile incinerator eliminates diseases while on-site

Source: WasteSpectrum[13]

Problem 2 – In the building material industry, time to market and quality is important, making down-time costly. Continuous monitoring, improvements, innovations and training is a priority for firms operating in the industry in the face of a competitive and highly demanding construction market.

Innovative solution 2 – Aircrete provides high-volume factories for autoclaved aerated concrete (AAC), which is lighter, fire proof and more environmentally friendly than traditional concrete. Aircrete uses their own production technology in manufacturing plants for precise cutting, which minimises production cost and waste as well as enables production of AAC blocks and AAC panels.

The mid-size firm however does not see itself as a machine supplier but as a complete business provider. In order to increase its value proposition to its customers, Aircrete started to focus on providing services five years ago as part of their strategy to provide clients fully vertical business services. The shift from machine supplier towards technology partner was a strategic move to differentiate and position themselves on the market of AAC, increase sales as well as establish long-term customer relationships and further increase their client base. Their provision of spare parts, maintenance, improvement programs, educational programs and consulting is constantly growing and Aircrete is looking to further expand their service offerings in their existing factories as well as in hundreds of other factories world-wide. The service layer expands beyond technical support to business and product application support.

Their service contracts, which consists of maintenance, check-ups, analysis and reports, are typically signed for 5 to 15 years on a yearly fixed price where additional services are priced incrementally.

Aircrete provides high-volume factories for autoclaved aerated concrete (AAC), with cutting edge technology machines that incorporate monitoring and preventive services

Source: Aircrete Europe[14]

Problem 3 – Manufacturers are facing strong competition from overseas which in turn puts pressure on production efficiency, quality and reliability. Companies are thus turning to big data to obtain insights, but in order to make sense of the information, it must be presented in real-time, and be accurate, structured and understandable to fulfil reliable, qualitative and efficient production processes.

Innovative solution 3 – PlantVision's predictive maintenance software solution, PlantPerformance, fulfils their clients' demand for reliability and availability in production. The software provided helps manufacturers realise when their

machines needs support through connected devices. This primarily decreases down-time and optimises production, but also switches focus from "historical plant performance discussions" to "what's next discussions".

PlantVision used to sell licenses and add-on support as a One-Time-Sale (OTS) or as lump sums but recently switched their service offering towards a Software-as-a-Service (SaaS) model. Their clients are therefore offered service contracts which stretch over 5 years, meaning that previous one-time investments are now spread out over a period of time with lower yearly fees. The idea was to create longer term relationships and further develop the product and services in collaboration with the client. Having the cost spread across a number of years instead of as a large upfront investment further allows for faster, more flexible, decision making thus enabling faster adoption of PlantVision's service offering.

PlantVision's software solution for predictive maintenance, PlantPerformance, helps manufacturers realise when their machines needs support through connected devices

Source: PlantVision[15]

Problem 4 – Manufacturers operating in the pharmaceutical process industry may experience down-time due to machine break-downs or other deficiencies in the production process. Such delays are costly to these firms, especially when they operate product campaigns with a narrow window. Compounding this, companies often do not have onsite maintenance expertise, lengthening reaction times to production issues.

Innovative solution 4 – Issues concerning new types of defects on new machines, unknown or unpredictable differences on product appearances, erroneous failure detection by machines, and common failures regarding mechanical or electrical deficiencies are some of the issues which Brevetti's clients face.

As such, remote monitoring with instant access to their clients via their Human Machine Interface and Programmable Logic Controller systems allows Brevetti to troubleshoot and fix issues remotely on the most critical parts of the machines. Predictive maintenance is used to detect errors before they occur which allows their clients to stop the machine for maintenance in a much more convenient way. Embedded engineers are available for instant support throughout the world, comprising of in-house engineers and a network of service providers. These solutions combined with R&D, storage of spare parts, online and phone support enable Brevetti to provide maintenance services instantly. In addition, embedded engineers from Brevetti who are situated onsite at the client are highly appreciated and serve to enhance the customer experience, thus contributing to better relationships between Brevetti and its clients. However, there are challenges with placing embedded engineers abroad, for example in countries where stability and security is low. Fulfilling labour requirements and obtaining working permits for a specified period of time (which is at least 200 days in Brevetti's case) can take several months, especially in Switzerland, and this in turn negatively affects the ability to provide local support. Another issue that Brevetti faces is in motivating their engineers to stay abroad for at least 200 days. To incentivise this, the engineers are offered extra pay and bonuses based on the number of days abroad as well as amount of work being achieved.

Brevetti C.E.A typically signs a 10-year contract with their clients that ensures reliable services world-wide, 24 hours a day, 7 days a week. So far, the services provided are in conjunction with machines manufactured by Brevetti because their systems are unique and specialised, preventing them from providing similar services on their competitor's machines.

Brevetti's automatic and semi-automatic inspection machines are using predictive maintenance and remote monitoring solutions

Source: Brevetti C.E.A[16]

3. Impact of the trend

Firms are constantly challenged to innovate and think ahead in order to be able to effectively compete with low-cost competitors. Here, offering services is growing rapidly as a strategy to ensure differentiation. The desire of companies to prevent the failure of critical assets and to do so through lower costs are raising demand for efficient and effective maintenance services. Simultaneously, firms are increasingly adapting new technologies which firms providing

maintenance solutions have an opportunity to take advantage of.

3.1. The market potential of the trend

Maintenance costs across European production locations are estimated to be EUR 4.5 billion annually.[17] **The market for maintenance, repair and operations is estimated to grow to approximately EUR 33 billion by 2025** with **margins on services on average 10.7 per cent higher than on products.** [18] Top performers in field services experience **88 per cent customer retention** (compared to 76 per cent experienced by low performers) and **annual service revenues of 7 per cent compared to 1 per cent.**[19] One study indicated that almost 30 per cent of organisations recognise that services offer a means of creating **new revenue streams** when margins on products fall.[20] 60 per cent claimed that services were provided for competitive reasons to achieve differentiation. [21] Manufacturers that put the greatest emphasis on services and which include services into their strategy and planning activities on average tend to benefit from a 10 per cent rise in annual revenues. **68 per cent of the respondents in an Oxford Economics survey predicted that performance-based service contracts will be the top service strategy within 3 years** with a growth rate of 60 per cent. [22] The same survey also suggested that a manufacturer with an annual revenue of EUR 4.5 billion and a profit margin of 20 per cent would generate a EUR 147 million increase in service revenues, according to a business-impact model made, by adopting service strategies. There is potential and a demand for maintenance services which can be drawn from the fact that only 22 per cent of maintenance managers are satisfied with their current maintenance programs. Furthermore, 40 per cent of manufacturing executives rated the failure of critical assets as the main operational risk of performance. Applying a mix of reactive, preventative and predictive maintenance services upon asset criticality are thus considered the most cost effective mixture, with predictive maintenance possibly offering the most affordable option.[23]

3.2. Transformative power of the trend

The most vital transformative power of the trend is that manufacturers are moving from **product providers to service providers**. Manufacturers have traditionally been relatively slow and uninterested in building relationships with customers – they bought raw material, processed it and pushed it out on the market. However, times are changing. The consumer device industry has been on the forefront of tracking and understanding their customers and providing help and suggestions on what to buy based on previous consumer preferences. Now, the increasing affordability of sensors and microchips creates the opportunity for connected machines to relay customer preferences based on usage data and in turn allows manufacturers to explore new types of services.

OEMs are therefore reshaping their business models. OEMs are starting to compete with platform makers and retailers to gain customer loyalty and knowledge about the usage of their machines, and that is one reason why **OEMs are expanding in to providing services**.[24] Tracking the usage of their equipment via remote monitoring and sensor techniques allows for manufacturers to **resolve problems before they occur** either remotely, by sending technicians and also by providing training sessions on exactly how their products work.

Gaining trust from manufacturers and knowledge about their business are vital for OEMs. Since products are not to be sold alone but with service contracts guaranteeing years of services, relationships between OEMs and their customers will become increasingly intimate. Periodical prescriptions based on contracts are also reflected in manufacturers' cash flows, with one-time-investments (OTIs) being switched out for long-term periodical payments, affecting accounts associated to cost of operations instead of liabilities transforming businesses.

"We make sure that our initial visit and the vaue of our service is visibile from the beginningl"
*– **AirCrete***

OEM organisations will also experience increased competition of service offerings from multiple providers such as other OEMs, third-party service providers and service delivery partners, thanks to the significant prospects for growth and profitability in the service industry. In turn, organisations will seek to deliver relationship-building services that enhance customer value, as opposed to transactional services that can be commoditised with prices accordingly driven down.[25] New opportunities are created for distributors to gain competitive advantage and higher reliability by collaborating with OEMs that in turn are offering advanced services based on new technologies.[26] So far the trend has had most power among bigger, well established firms with the financial muscle to manage the transition towards services, but **the transformation is expected to reshape smaller OEMs in near future**, thanks to increased awareness and appetite among customers for such advanced services, as well as continued advances in technology leading to the increased affordability of sensors and remote monitoring equipment.[27]

3.3. A source of skilled employment

OEMs have traditionally relied on labour with skills in the area of mechanical and electrical engineering; however, the shift towards a product-as-a-service business

"We train engineers...we train the distirbutors on site as well as doing training courses herel"
*– **WasteSpectrum***

model means that **there is a demand for new types of specialists** (for example information technology specialists) in what once was an industry for engineers solely.[28] The demand for skilled workers is predicted to rise by more than 16 million where of **8.5 million new jobs are to be created within knowledge and skill-intensive occupations such as technical jobs.**[29]

4. Drivers and obstacles

4.1. Changing customer preferences and the need to better understand the customer are driving the demand for service contracts

Manufacturers are expecting better, more reliable and faster services, forcing OEMs and third-party service providers to change towards a more customer-centric approach.[30] Pressures on efficiency, reliability and quality put manufacturers and service providers in a seat where they have to deliver on-time, every time with high standards of quality. It is a part of the service offering and a priority in order to compete against low-cost manufacturers and undergo the transformation from product maker to service provider. The will for OEMs and equipment providers to sell their products and retain manufacturers requires intimate relationships and an understanding on how manufacturers make use of their products, which in turn drives the offering of service contracts onwards.[31] Providing long-term service contracts with fixed monthly, to yearly, fees allows highly reliable forecasts in predicting future revenues thus enables planning and development for future demands. Furthermore it encourages intimate relationships allowing for goal congruence to be achieved. Manufacturers tend to appreciate collaboration with OEMs and service providers to further develop their products and processes and vice versa. This means that bundled services do not just encompass maintenance and repair, but other value-adding services such as training and management consulting. Preventive and especially predictive maintenance are driven by fulfilling several aspects described earlier, for example by reducing machine down-time in order to adhere to delivery dates.[32] Manufacturers tend to rely more and more on OEMs and equipment providers to provide services since in-house expertise is less frequent. Training and guidance are of importance for in-house technicians to provide basic maintenance services and expertise to provide a range of advanced services, for example fine tuning newly installed machines or optimising operations.

"Today, they have less and less expert people within the organisation so they are relying more and more on our service."
*– **Brevetti C.E.A***

4.2. IoT and Industry 4.0 enables advanced maintenance services

The **European industrial sector is estimated to invest EUR 140 billion per year until 2020** in industry 4.0 solutions (which include predictive maintenance and remote monitoring solutions), with annual revenues of EUR 110 billion arising from digitalisation and interconnection.[33] Industry 4.0, the fourth revolution of manufacturing, is digitalising and linking together all productive units in an economy.[34] For example, it is estimated that more than 70 per cent of Swedish SMEs will achieve a high utilisation rate of digital technologies and solutions within the next five years.[35] Moreover, in a recent study, 77 per cent of CEOs believed that investments in digital technology created value through increased customer experience.[36]

More services and further differentiation goes hand-in-hand with the introduction of intelligent services which in turn are derived from the Internet of Things (IoT). IoT enables the use of predictive maintenance by increasing the demand signals' accuracy to detect and immediate address failures. This often comprises of Internet-enabled sensors and analytics which are applied on equipment and communicate over larger geographical areas. Investing in IoT capabilities was initially expensive but prices have since decreased to a level where small manufacturers are now able to equip their machines with the latest technology.[37]

Smart products are software intensive and part of a network equipped with **sensors and connections for instant feedback** to the original manufacturer, and are as such **key in offering products as services.**[38] In particular, big data, machine-to-machine (M2M) and cloud services drives predictive maintenance which in turn enables products as services. Big data tools helps structure the existence of unstructured data to readable predictive data.[39] The emergence of M2M are broadening the number of connection points and enables communication between machines.[40] Through a vast combination of smart machines including software tools, applications and mobile devices, machines become smart enough to communicate their state of health.[41] In turn, the cloud enables collaboration between OEMs, manufacturers and third-party

"Big data is a hot topic in production right now."
*– **PlantVision***

service providers.[42] Collected data are transferred into central-based cloud dashboards where key-performance indicators are shown in real-time, accessible anywhere and anytime for the right people.[43] The cloud enables data storage at less cost compared to in-house servers, which to a great extent drives SMEs to adopt such solution and elaborate their services. Technology and innovation is a key factor in enabling SMEs to be part of global value chains.[44] However, there remain some challenges that need to be addressed before these value chains become fully digitised. These challenges include the lack of necessary standards and cyber security capacities. [45]

4.3. Product-as-a-service is viewed as a premium rather than a necessity

Offering life-time support does have restrictions. It is in fact difficult to sell service contracts to SMEs in the B2B sector as well as end-customers in the B2C sector overseas as **they cannot physically see what they are buying** and the service contracts tend to involve extra costs. People buying the product from the OEM tend to rely on basic support kits and contact a service repairman after the actual failure has occurred. Selling the product itself is considered easier because the customer knows what they invest in and what value it brings. The service-sales paradigm has been highlighted as a significant challenge and organisations are looking on how to align the two.[46]

"It's almost like you are selling an insurance."
*– **WasteSpectrum***

4.4. Providing own services or outsourcing when service contracts span geographies

Service contracts are experienced as easier to sell when services are performed and controlled by the OEMs' own personnel rather than personnel associated with their distributors. Likewise, selling service contracts through distributors means that the ownership of service offerings are transferred from the OEM to the distributor leading to less control over sales and service management processes and even worse to missed sales opportunities for further growth. The quality of services depends on the quality of the labour. As such, if service contracts are to be offered and hiring of personnel are outsourced to distributors, the quality of services are unreliable in that way that they are not controlled. **Obtaining reliable foreign representation** and **maintaining control over foreign middlemen** are both viewed as fairly high obstacles for SMEs in general according to a study on the role of SMEs in global value chains.[47] It is also a challenge for OEMs to find people willing to undertake time consuming projects abroad when own services are offered overseas, for example supervision of complex machinery in the B2B sector.

"We compete on different terms around the world."
*– **PlantPerfomance***

4.5. Hiring talented labour to drive innovation is a challenge

Hiring and maintaining a talented workforce is in general considered a challenge for OEMs as well as SMEs, which are pressured to deliver innovative capacity in order to participate in global value chains. [48] Transforming from a product supplier to a service supplier requires modifications, even a new type of workforce with the right competence to perform maintenance services on specialised in-house developed products. This is even more pronounced if these services are extended outside their own product line.

"It's challenging to be able to provide high skill resources to final customers, to have them staying away from home for a very long time."
*– **Brevetti***

4.6. Lack of knowledge on how to shift towards servitisation

As manufacturers progressively become aware of the benefits of adapting new technology, either to become servitised or to be served, many have yet to achieve this. Some manufacturers in more traditional industries, such as the paper industry, have less appetite to sign contracts for the lease of predictive maintenance services, in part due to **a lack of awareness and understanding from top management** and in part due to **cultural barriers** that prefer traditional methods of working.

SMEs in particular may not have the expertise and resources needed to transform their business from an emphasis on products to an emphasis on services and solutions. This can **mean a lack of knowledge on who to partner with and how to properly draft up service contracts**.

5. Policy recommendations

Policymakers can support servitisation efforts by providing collaboration and knowledge platforms which not only help educate entrepreneurs and business executives on the potential associated with servitisation, but create matchmaking opportunities between firms. Access to a skilled workforce that has expertise in relevant fields such as Internet of Things and big data analytics is also key. Finally, raising awareness about the value proposition of predictive maintenance services is also important..

5.1. Encourage collaboration and sharing of knowledge

Courses and further knowledge can provide guidance for SMEs on how to leverage their business model to become servitised and actually make use of existing investments in tangible and intangible assets such as big data. It could also spur the access to adoption of new technologies which are vital for SMEs to provide customer-centric services in global value chains.[49]

"Following a course from Aston University we pushed it a bit harder and it is starting to growing."
*– **WasteSpectrum***

Transformation of SMEs into service providers can be supported through the development of standardised frameworks for setting service contracts. This may not only encourage SMEs to offer predictive/preventive maintenance services, but can also tackle the challenge of unreliable services performed by distributors. These frameworks could be customised to the specific needs of OEMs and distributors.[50] Developing standardised frameworks on practical steps when starting or changing the service offering would minimise the learning gap between "selling the product" and "selling the product-as-a-service".

5.2. Stimulate and provide interfirm networks and matchmaking opportunities for SMEs

Adopting servitisation does not happen overnight. It is a continuous operation which builds on trust between supplier and buyer of services. Big and well-established firms, rather than SMEs, are at the leading edge of offering life-long support services. Many of them have already incorporated service-as-a-product into their business model and have the financial resources to do so. It is the **OEM start-ups and smaller third-party service providers that need support**, both in the development phase of hardware or software solutions but likewise for providing the actual on-site maintenance.

These 'smart' business services are important as enablers for the shift towards servitisation. This could entail matchmaking opportunities between SME service providers/OEM and larger manufacturing firms. Such support would help to raise the awareness of smaller service providers and enable sufficient investments in resources to take on maintenance services. Likewise, **creating a platform for interfirm networking** would potentially contribute to strategic alliances and joint-ventures between SMEs and/or SMEs and multinational corporations, strengthening value chains as well as accelerating learning and trustworthy relationships between enterprises.[51]

5.3. Improve access to skilled workforce

Finding skilled labour to adopt servitisation is also difficult for OEMs. Therefore education and training programmes for engineers should be continually updated to better prepare newly graduates as well as experienced hires and provide the market with a talented workforce needed for the shift towards predictive and preventative maintenance. This includes expertise related to big data, analytics, IoT and other emerging technologies.[52]

"To hire this type of people here is challenging."
*– **Brevetti C.E.A***

5.4. Raise awareness about the value of maintenance services

Policy makers also have a role to play in raising the awareness of manufacturers on **how maintenance service contracts could streamline financial revenue and cost streams** in changing from OTIs to "lease of services". It could potentially lead to further **increase in demand of predictive maintenance, remote monitoring and similar services** offered by SME OEMs. In Germany for example, the government launched "Industry 4.0" strategy in 2011 to support the transformation of the German industries.[53]

Companies should understand that instead of costly OTIs, servitisation investments are spread out over time and coupled with guaranteed services, which can ease cash flow concerns. That in turn would increase demand of services offered by SME OEM and/or third-party service providers.

6. Appendix

6.1. Interviews

Company	Interviewee	Position
WasteSpectrum	Neil Rossiter	Managing Director
PlantVision	Magnus Severin	Founder and Managing Director
Aircrete	Wojtek Horala	Business Development Manager
Brevetti C.E.A	Massimo Frasson	Managing Director

6.2. Websites

Company	Web address
WasteSpectrum	www.wastespectrum.co.uk
PlantVision	www.plantperformance.se
Aircrete	www.aircrete-europe.com
Brevetti C.E.A	www.brevetti-cea.com

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